Northern Rockies Weather Watch
NWS Missoula, Montana
Fall 2007

July 2007 - Warmest Month on Record for Many Areas of Western Montana.

A persistent ridge of high pressure brought record heat and dry conditions to Western Montana during the month of July. The extreme heat and dry conditions not only led to near record low stream and river levels, but also to a severe fire season that brought back memories of the 2000 and 2003 fire seasons.

Record Average High Temperatures July 2007

Missoula: 96.5 F – 12.9 F above normal and 2.7 F warmer than the record, previously set in 1960.
Butte: 88.8 F – 9.1 F above normal and 2.6 F warmer than the record, previously set in 2006.
Kalispell: 92.0 F – 10.2 F above normal and 0.8 F warmer than the record, previously set in 1960.

Many other records were set during this period. Below is a listing of several of the new records that were set for Missoula.

Hottest Temperature Ever – 107
- July 6, 2007. The previous record 105 F, was recorded on several different days.

Warmest Night Ever – 71
- July 24, 2007. The Previous record of 69 F was recorded five days earlier, on July 19.

Record number of days with high temperatures of at least 100 – 11
- The old record was 6 days in 1936. An average year has 0.5 days of 100 F or greater temperatures.

Record number of days with high temperatures of at least 95 F – 24
- The old record was 20 days in 1960. An average year has 4 days of 95 F or greater temperatures.

Record number of days with high temperatures of at least 90 F – 53
- The old record was 41 days in 1940. An average year has 18 days of 90 F or greater temperatures.

Driest July on Record at KMSO – 0.02”
- Old record was 0.09” recorded in 1973 and 1985. In an average year KMSO receives 1.09” of rain in July.

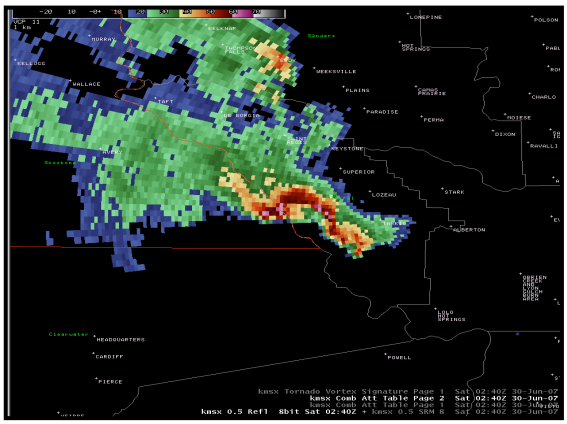
Tornado!

"I'm standing here at the Dworshak dam looking at a funnel cloud" Clearwater County Emergency Manager Don Gardner said as he phoned in a report to the National Weather Service office in Missoula early on the evening on June 29. In addition to wind damage and large hail, the storm had already produced two funnel clouds earlier as it moved across the Camas Prairie. There was a good possibility that one of these funnel clouds may touch down, possibly putting someone's life in danger. "Ok Don, thanks for the report. Just to let you know, we are in the process of upgrading our Severe Thunderstorm Warning to a Tornado Warning. Please keep us advised if you witness or hear about any tornado damage," Meteorologist Bryan Henry replied as he prepared to send out the Tornado Warning. The tornado warning was issued at 6:23 pm PDT.

Severe Thunderstorm winds damaged vehicles in Orofino. Courtesy of Clearwater County EMA

Doppler radar data continued to show a thunderstorm with a strong, rotating updraft moving to the northeast from Orofino toward Pierce and Weippe. For the next half hour, the NWS warning forecasters canvassed the area for storm reports. Several reports of hail stones as large as golf balls were received. Numerous trees were blown down in the Grangemont road area. However, the description of the damage more closely resembled straight line wind damage than tornado damage. Another funnel cloud report was received, but no tornado reports had come in yet. Then at 6:49 pm, a weather spotter about 15 miles northeast of Orofino reported a tornado on the ground near her house. Later, another spotter in the same area reported that she had witnessed a tornado traversing a nearby hill around the same time. A few more tree blow downs were reported by the USFS in the Clearwater National Forest between Pierce and the Montana state line.

As the storm neared the state line, it re-intensified. The town of Superior lay in the storm's path. Doppler Radar imagery strongly suggested the storm had regained its tornadic tendencies and a funnel cloud might touch down. Once again, the Severe Thunderstorm Warning was upgraded to a Tornado Warning. Fortunately, the storm began to weaken near Oregon Lakes shortly after crossing the state line. By the time the storm reached Superior, it had weakened into just a borderline Severe Thunderstorm. Other than a few downed trees, NWS storm survey crews were unable to find any tornado tracks in the formidable terrain.



The tornadic storm viewed from the Doppler Radar

Straight Line Winds Pummel Lincoln County

Trees snapped near Yaak. Courtesy of John Runkle.

While Clearwater County and Mineral County were dealing with their storm, an even stronger storm began to intensify near Coeur d'Alene on the evening of June 29. The storm's northeasterly track put it on a collision course with Libby, Troy, Yaak and Eureka. Though not tornadic, this storm had high potential to produce substantial wind damage should it maintain its strength. Unfortunately, this is exactly what happened when it moved through Lincoln County and eventually into SE British Columbia.

The type of storm that moved through Lincoln County was identified as a Bow Echo. A Bow Echo gets its name in part from its shape which resembles an archer's bow on radar reflectivity data. Such storms often produce damaging winds as they transfer strong upper level winds to the surface. Bow Echoes have an unusually long life span that can last for more than 6 hours. The Lincoln County storm lasted between 3 and 4 hours. The amount of wind damage received from a Bow Echo can be as devastating as the damage received from a tornado, perhaps worse.

So what happened? As the storm raced through Libby and Troy, wind gusts of at least 75 mph snapped power poles, knocked down numerous trees, and took out power to both communities. One large tree fell onto a hiker. Rescue workers had to cut their way through fallen trees along the trail in order to get to the injured hiker. Yaak was hit even harder. Numerous 100-year old trees were either uprooted or snapped. Some of these trees landed on buildings and vehicles, causing extensive damage. Portions of the roads into town were blocked by downed trees. The community was without power for several days as the power company worked to restore power. Fortunately, there were no injuries reported in Yaak.

Given the extensive damage reports received along with new radar data indicating that the storm was maintaining its intensity, the Severe Thunderstorm Warning was extended. The assumption was the storm would continue to produce significant wind damage at least until it crossed the US/Canadian border at Roosville. Several minutes after the warning was extended, damage reports began trickling in from locations along US Highway 93 from Eureka to Roosville. Roof damage to a building was reported near Eureka. Several large trees and branches were blown down onto power lines. The Port Authority at Roosville said travelers had given them several reports of trees blown down onto trailers in Southeast British Columbia. The severe weather events of June 29 produced extreme weather across Northwest Montana and Northern Idaho. However, nobody knew that both of these events would quickly be shadowed by another, more intense event that would produce incredible damage just 3 weeks later in mid July.

More damage in Yaak. Courtesy of John Runkle.

The Big One: July 18, 2007

It was 3:30 pm, and there wasn't a cloud in the sky. Most of the computer models indicated things were expected to get really "interesting" in the next 2 to 4 hours. Where were the clouds?

A strong cold front with exceptional upper level support was expected to sweep across Western Montana during the evening hours. As it approached, the models suggested that there would be a sudden surge and release of atmospheric instability. The release of atmospheric instability was expected to interact with the passing front and associated moisture to create intense thunderstorm activity. Timing was everything. If the frontal passage was delayed, then the atmospheric instability ahead of the front would lessen, and the thunderstorm activity may not occur at all.

The front began to move into extreme Northwest Montana around 4:30 pm. The early signs of convective development began as cumulus clouds formed over the northern Bitterroot Mountains. Thunderstorm development was only an hour or two away. NWS Warning forecasters prepared for the significant severe weather potential.

Supercell in Lake County. Courtesy of Lake County Sheriff

As the front approached, thunderstorms began to develop first along the peaks of the Northern Bitterroot Mountains and then over the Cabinet Mountains. The first of many Severe Thunderstorm and Tornado Warnings was issued at 6:19 pm. The first storm report came from a spotter in Tarkio where golf ball size hail was observed. The storm also knocked out the power to Superior. The cold front was still over Northwest Montana. The event was only beginning.

Just after 7:00 pm, the Storm Prediction Center (SPC) in Norman, Oklahoma, called to propose the issuance of a Severe Thunderstorm Watch. Like us, they expected a rapid intensification with the thunderstorm activity within the hour. The watch was issued. Skywarn was activated to help National Weather Service forecasters with the event.

While all of this was occurring, a storm in Sanders County began to show tornadic tendencies as it neared the Lake County line. The Severe Thunderstorm Warning was upgraded to a Tornado Warning. The first of three tornado reports came in at 7:58 pm from the police dispatch office in Ronan. A severe weather spotter near Pablo had just called them saying that he saw a tornado a few miles west of Pablo. Following that, numerous reports of widespread wind damage were received from a variety of sources including trained weather spotters, Ham Radio operators, the public, Law Enforcement, and Emergency Management. As the storm moved over Flathead Lake, a waterspout was sighted north of Polson. Numerous trees were blown down along the west shore of the lake. Winds that were estimated to be as high as 100 mph. As the waterspout continued its track over the lake, it struck a 28-foot sailboat, spun it around at least one time in a counter-clockwise manner, swamped, and then sank it. Somehow, the two individuals on board survived and were rescued. Their only injuries were bruises on their backs from being pelted by large hail. It was now 8:30 pm and the storm was heading toward Kalispell.

As the storm began to approach the northern shore of Flathead Lake, in southern Flathead County, it began to lose its tornadic characteristics and changed in to a Bow Echo. This was the worst case scenario. With a weak tornado, the damage might not be as widespread; it would likely be confined to the tornado's track. With a Bow Echo the resulting

Flathead County Microburst. Courtesy KECI Weather Spotter

straight line wind damage had the potential to be more widespread, potentially impacting the entire town. Suddenly, Kalispell lost power as power poles were snapped and power lines were knocked down. During a horse race, the roof to the Carpenter's Arena was blown off, killing one horse and injuring another. Amazingly, none of the hundreds of spectators in the arena were injured.

Things became eerily quiet in the forecast office. Forecasters were unable to obtain new storm reports. The Skywarn Ham Radio operators rushed to gather new information via short wave radio. They were able to obtain several critical storm reports, which were relayed to the forecasters. This information was quickly disseminated to the website, NOAA weather radio, and the media. The storm finally weakened as it moved into Glacier National Park, and the warning was allowed to expire.

While Kalispell was being hit, another severe thunderstorm developed south of Libby. It quickly developed the potential to produce 80-100 mph winds. A Severe Thunderstorm Warning was issued for Lincoln County. As the storm moved through Libby, it blew down the drive-in theater and knocked over the fence to a baseball field. Electricity was lost to the town as trees and tree limbs fell onto power lines.

Other evening storms developed and caused significant damage as well. A storm developed over Lonepine and blew down several large trees. Winds from this storm also blew out several mobile home windows. Late night storms redeveloped over both Flathead and Lincoln Counties and produced severe thunderstorm wind gusts that knocked down additional large trees.

A NWS Storm Survey Team was sent out the next day to assess the extensive damage across Western Montana. Below are some photographs of the damage observed.

NWS Missoula Conducts Two Open House Events

On May18 and 19, NWS Missoula celebrated NOAA's 200th anniversary by conducting two open house events. In addition to celebrating the anniversary, we wanted to show our appreciation to everyone who has helped us accomplish our mission of protecting lives and property. The first day was focused toward showing appreciation to the media, local businesses, and the various Government agencies and officials. The second day was dedicated to you for the help provided whenever significant weather occurs. Your timely spotter reports have been instrumental in helping us protect lives and property.

Cakes courtesy of Shannon Dickerson

The events on both days started off with a presentation on the history of NOAA. Following that, an extensive office tour was given in order to showcase NWS technology and the operational functions of a weather forecast office. A educational booth for children was set up outside the office. The interactive games and learning activities were a huge hit. Drinks and refreshments were supplied for those in attendance.

NWS Missoula wishes to thank everyone out there who made this event a huge success.

Fall and Winter Spotter Training

What do the images below have in common? Give up? They are all indicators or examples of severe weather. Each photo comes from a severe weather event that occurred over North Central Idaho or Western Montana over the past 6 months. Yeah, it really happened here, even the snow in Philipsburg!

We need your help! Not only can you help by providing timely severe or significant weather reports, but also by asking friends and family members to become NWS severe weather spotters. Another thing that you can do to help is to schedule a spotter training session in your town. All we need is a time, date and location. We'll do the rest. So, please call either Peter Felsch or Bryan Henry at (406) 329-4840 to schedule your talk. (You can reach us by email at: Peter.Felsch@noaa.gov or Bryan.Henry@noaa.gov.)

NOAA Reports U.S. Likely to Have Above-Average Winter Temperatures

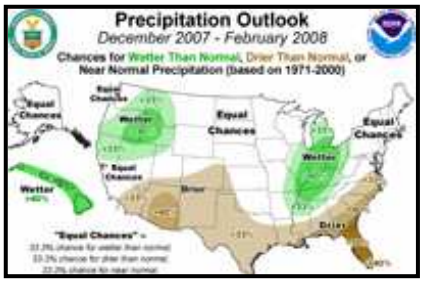
La Niña Arrives, Southern Drought Concerns Intensify

NOAA forecasters are calling for above-average temperatures over most of the country and a continuation of drier-than-average conditions across already drought-stricken parts of the Southwest and Southeast in its winter outlook for the United States, announced at the 2007-2008 Winter Fuels Outlook Conference in Washington, D.C., today. The exception is the Pacific Northwest including Idaho and Western Montana where moist conditions are expected.

"La Niña* is here, with a weak-to-moderate event likely to persist through the winter," said Michael Halpert, head of forecast operations and acting deputy director of NOAA's Climate Prediction Center. "The big concern this winter may be the persistence of drought across large parts of the already parched South. And while December through February is likely to be another milder-than-average winter for much of the country, people should still expect some bouts of winter weather."

For the 2007-2008 U.S. winter, from December through February, NOAA seasonal forecasters predict:

- In the Northwest, including Idaho and Western Montana, there are equal chances for above-, near-, or below-average temperatures. Precipitation should be above average in much of the region due to La Niña.
- In the Northeast and the Mid-Atlantic, temperatures are expected to be above average in response to the long-term warming trend. Snowfall for the region will depend on other climate factors, which are difficult to anticipate more than one-to-two weeks in advance.
- The drought-plagued Southeast is likely to remain drier-than-average due to La Niña, while temperatures are expected to be above average.
- In the Great Lakes and Tennessee Valley, temperatures and precipitation should be above average.
- The south-central Plains should see drier-than-average conditions and warmer-than-average temperatures. Above-average temperatures are also expected in the central Plains. The northern Plains has equal chances of above-, near-, or below-average temperature and precipitation.
- Drought conditions are expected to persist in the Southwest due to La Niña, and temperatures are likely to be above average.
- Northern Alaska is expect to be milder–than-average, while the rest of Alaska has equal chances of above-, near-, or below-average temperatures and precipitation. In Hawaii, temperatures and precipitation are expected to be above average.



The U.S. winter outlook is produced by a team of scientists at the Climate Prediction Center in association with NOAA-funded partners. Scientists base this forecast on long-term climate trends and a variety of forecast tools from statistical techniques to extremely complex dynamical ocean-atmosphere coupled models and composites.

La Niña events are characterized by an unusual cooling of the sea surface temperatures across the eastern portion of the Pacific Ocean. La Niña events tend to produce warmer and drier conditions across most of the country.

National Weather Service
Missoula Montana

Spotter Network Reporting Procedures

When you observe or hear of weather conditions that **meet** or **exceed** the criteria listed below, telephone your report **immediately** to the National Weather Service office in Missoula. Our toll-free number is:

1-800-676-6975*

- **TORNADO** (on the ground), **FUNNEL CLOUD** (not touching the ground) or **WATERSPOUT**
- **HIGH WIND** - 40 mph or more, sustained or gusts (use wind speed estimates below)
- **HEAVY RAIN** - one-half inch (0.50) or more per hour
- **FLOODING** - any kind (e.g. rivers/streams abnormally high, water over roads, ice jams)
- **DAMAGE** and/or **DEATHS** and/or **INJURIES** - weather related
- **HAIL** - any size (use hail size estimates below)
- **FREEZING RAIN** (falls as rain, freezes on impact)
- **VISIBILITY** - less than 1/4 mile for any reason (e.g. dense fog, smoke)
- **HEAVY SNOW** - one inch or more per hour

When calling in your report, please tell us briefly:

- What you have seen (tornado, heavy rain, etc.)
- Where you saw it (direction/distance from a known position)
- When you saw it (time of your observation)
- What it was doing (movement/destructiveness, etc.)

Give your name and location each time you report, and report only the above **significant** weather events.

* unlisted number, **ONLY** for weather reports

Wind Speed Estimates (MPH)

25-31	Large branches in motion; whistling in telephone wires
32-38	Whole trees in motion
39-46	Twigs break off trees; wind impedes walking
47-54	Slight structural damage; branches break
55-63	Trees uprooted; considerable structural damage
64-74	Widespread structural damage
75+	Peels surface off roofs; windows broken; trailer houses overturned

Hail Size Estimates

Pea	¼
Penny	¾
Nickel	⅞
Quarter	1
Half Dollar	1 ¼
Ping Pong	1 ½
Golf Ball	1 ¾
Lime	2
Tennis Ball	2 ½
Baseball	2 ¾

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